Organization(s): CFD Research Corporation

**MTO   Composite
CAD**

Title: Multiple Scale Design Tools for Non-Homogeneous Microfluidic Biochips with Electronic/Optical Readout

Duration of Effort: January 2, 2001 - June 30, 2001

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Objective

Develop multiscale modeling and design tools for biomicrofluidic chips processing non-homogeneous media (fluids with particles) in physical fields controlled by transduction circuitry.

Progress/Results

– A methodology is being adopted for macroparticle transport in channels. This task has been started. Work will focus on large particles in microchannels for flow-particle interaction

– Work on calculation of field effects (flow, electrostatics, electromagnetics) on particles in a Lagrangian-Eularian frame is in progress. Interaction with electrostatics and AC fields is incorporated, work on electromagnetics interaction is underway.

Status

– Project started in January 2001
– Lagrangian transport model for small particles with volume displacement being incorporated
– Initiate testing of the algorithms on benchmark problems started
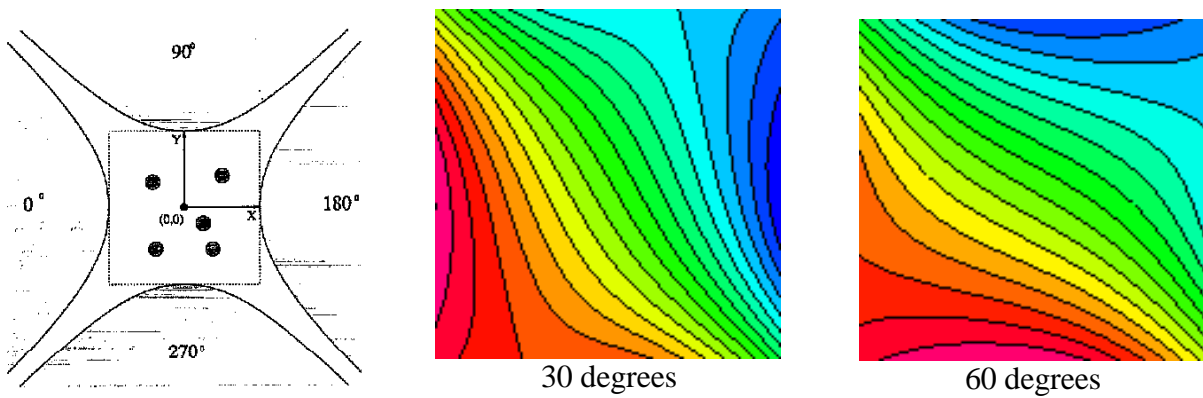
Sketch of 4 electrodes in AC field with phase shift and calculated potential distribution in the inner-electrode space at different cycle step for Dielectrophoresis
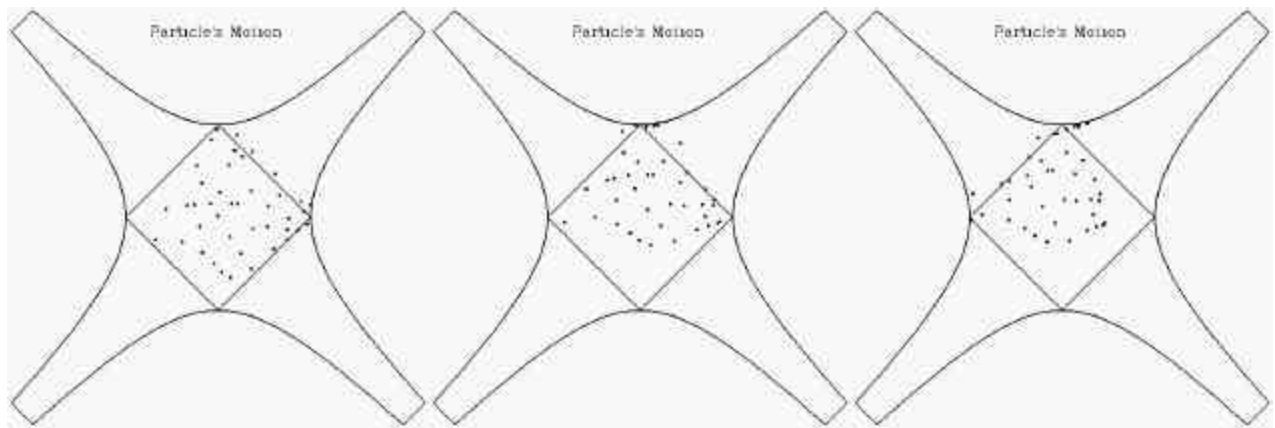
Calculated motion of the particles under the action of the rotating AC field shown above
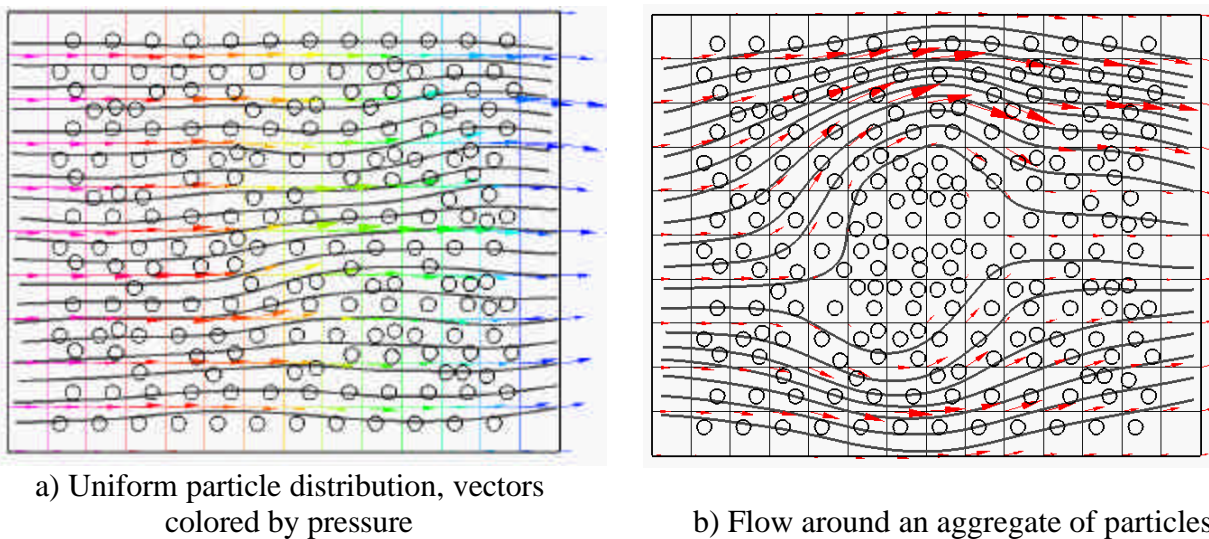
a) Uniform particle distribution, vectors colored by pressure

b) Flow around an aggregate of particles

Flow velocity vectors and streamlines for a channel flow of particle-laden fluid.